Customer Profile

Extending machinery life in a Polish power plant

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For economic reasons, more and more power companies are using Life Extension Programs to extend machinery life. One such company is Rybnik Power Station, a coal-fired power plant in Rybnik, Poland. The town of Rybnik is located in Southern Poland between Katowice and Poland's border with The Czech Republic.

Rybnik Power Station has eight 200 MW, steam turbine units (type 13 K 215), manufactured by ZAMECH in Elblag, Poland, driving eight hydrogen-cooled generators manufactured by DOLMEL. ZAMECH and DOLMEL are now part of the Asea Brown Boveri group. The turbines operate at 3000 rpm.

The first unit was put on-line in December, 1972, and has been in operation for over 140,000 hours. Failure rates of equipment on steam turbines, like other machinery, vary, and depend on several factors, such as thermal and stress fatigue, casing/rotor erosion and corrosion.

Modernization and Life-Extension Program

Operating this type of machinery today requires more and improved monitoring of the unit's condition and the plant's process than was designed-in thirty five years ago. Therefore, Rybnik Power Station decided to install new permanent monitoring and diagnostic systems on their units as part of a modernization and life extension project called "SYMO." SYMO consists of the following parts:

- Determination of the remaining life of the high and medium pressure casings (SYMO - LIFE)
- Determination of changes in the turbine's flow path (SYMO - ETA)
- Evaluation of the total unit's dynamic condition (SYMO - VIBR)
- Evaluation of bearing status (SYMO - BEARING)
- Evaluation of the generator's mechanical condition (SYMO - GEN)

The unit's primary mechanical condition monitoring is provided by a Bently Nevada 3300 Turbine Supervisory Instrumentation System. On-line dynamic condition monitoring (SYMO - VIBR and SYMO - BEARING) is achieved through the use of a Bently Nevada Transient Data Manager® 2 (TDM2) System. The other parts of the SYMO project are the result of mutual cooperation between Rybnik Power Station and the Silesian Technical University in Poland.

Shaft relative vibration monitoring is obtained by two internally-mounted proximity probes installed at each bearing 90° apart in an XY configuration. Their signals are connected to Bently Nevada 3300/61 Dual Vector Monitors, which provide continuous monitoring of the 1X and 2X vibration components, overall vibration amplitude, and shaft centerline position changes.

Bently Nevada Velomitors (one per bearing housing) measure absolute casing vibration. With no moving parts, a Velomitor® provides accurate and stable measurements and can provide many years of trouble-free service. Its principal of operation is based on a piezoelectric crystal at its core connected to on-board electronics consisting of a low noise amplifier/integrator.

The Bently Nevada TDM2 System provides significant new information on the unit's dynamic behavior which was previously unavailable to Rybnik Power Station's personnel. Mr. Jaromin, the senior turbine expert in the plant's diagnostic group, can now trend vibration changes in a much more meaningful way.

For example, analyzing transient data obtained during shutdowns indicated a

slight rotor rub at one bearing location. Although not a sign of a serious machine problem in this case, the information provided by the TDM2 System allows plant personnel to carefully monitor changes in this behavior and thus maintain production. Having diagnosed the origin and cause of the malfunction, it will be possible during the next planned unit outage to investigate the cause of the rub more thoroughly.

The transducer installation was straightforward and was done using tools and materials available at the plant site. Some additional mounting hardware was also fabricated on-site using existing equipment. Figure 1 shows the machine layout and transducer locations and orientations.

All of the mechanical work was done by Rybnik Power Station's personnel, under the supervision of Bently Nevada's Product Service group, which helped define transducer locations, monitor installation, and system commissioning. Bently Nevada's Product Service also installed and configured the TDM2 Software and provided on-site training. Since Rybnik's personnel had been so involved in the installation of the monitoring equipment on their first unit, they were able to complete most of installation on their second unit themselves.

The TDM2 System on both units uses a COMPAQ 486 computer and TDM2 Software. TDM and Dynamic Data Interface Communications Processors (CPs) allow operators to retrieve static, dynamic, and transient data from the installed 3300 Monitoring Systems. The database furnished by this diagnostic system provides the right input for Bently Nevada's Engineer Assist Software, which they plan to use in the future.

Process Control System

On one unit, all instrumentation has been completely modernized. In addition to the Bently Nevada 3300 Monitoring Systems, a new Westinghouse Computerized Process Control System has been installed. These two systems will be connected together in the near future, using the Serial Data Interface available on the installed System Monitors and on the new Communications Processor, the Transient Data Interface External (TDIX). This new system will replace the TDM Communications Processors Rybnik currently uses.

TDIX is an advanced line of Communications Processors, providing both steady state and startup/coastdown data. TDIX has been designed to take advantage of the advanced digital designs used in Bently Nevada's 3300 and 2201 Monitoring Systems. Even original-design 3300 Monitors can be easily upgraded in the field for use with TDIX. The Serial Data Interface (SDI) support built-in will provide high resolution gap and Not 1X static data, in addition to its normal features, such as channel alarm status, direct amplitude, and 1X and 2X amplitude and phase.

Using the SDI capabilities of these Bently Nevada products, static data can be cost-effectively transferred from Rybnik's 3300 Monitoring Systems to their Westinghouse Computerized Process Control System via the Modicon Modbus® protocol. All vital machinery data will then be available to Rybnik's operational personnel in the same format as other process data.

Conclusions

Use of these new systems allowed the plant to remove the original instrumentation and panel strip chart recorders they previously used to record trend information on the unit's behavior. As a result, their control room is more modern and convenient, their plant will be safer, and they will have greater control over their machinery.

Plant management is so pleased with the machinery information they have received from the first two installations that they have decided to install the same type of Bently Nevada equipment on the remaining six units. ■

For more information on Bently Nevada's TDIX, refer to "Transient Data Interface External" on page 18 of the March 1993 Orbit.

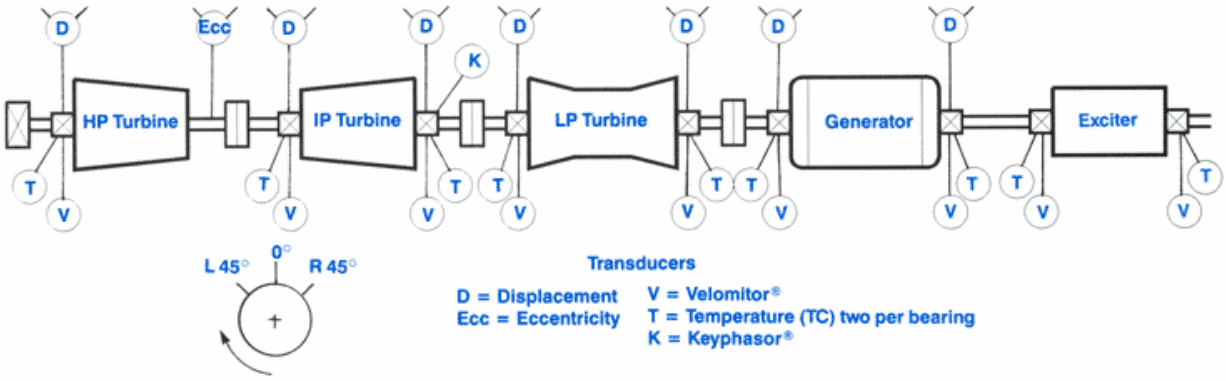

Figure 1
Machine layout with transducer locations, Rybnik Power Station. Note: The turbine is also equipped with Dual Voting Thrust Position, Case Expansion and Differential Expansion Transducers.